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ABSTRACT

This report summarizes two studies which documented the development of prelingually deaf children (N=4, N=40) in Sweden exposed to sign communication during preschool years. The first study involved analysis of video recordings, forming a qualitative description of social strategies used by four children with different social positions in the peer group. The second study compared results from a comprehensive testing program with 15-year-old subjects who had the early sign language exposure with previous results on orally trained deaf students. Results from both studies support the importance of easily accessible communication, i.e., a visual/gestural language mode, to social as well as intellectual development in deaf children. The study of social strategies found increasing importance of sign language. The structure and dynamic development of a group of children also had a great impact on an individual child's chances of success. The deaf eighth graders with early sign language showed superior achievement, particularly in understanding and use of written Swedish, but also in numerical and mathematical tests. (DB)

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DEAF CHILDREN'S DEVELOPMENT IN A TEMPORAL PERSPECTIVE: ACADEMIC ACHIEVEMENT LEVELS AND SOCIAL PROCESSES

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DEAF CHILDREN'S DEVELOPMENT IN A TEMPORAL PERSPECTIVE: ACADEMIC ACHIEVEMENT LEVELS AND SOCIAL PROCESSES

Kerstin Heiling

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The present report is a summary of a Swedish thesis comprising two studies both of which aiming at a documentation of the development of prelingually deaf children exposed to sign communication in preschool age.

The original group of subjects comprised 20 children born 1970-1974. In the second study, the group was extended to include classmates at the School for the Deaf - making a total of 40 subjects.

The first study is founded on detailed analyses of video recordings, forming a qualitative description of social strategies used by four children with different social positions in the peer group. *The second study* is a comparison of results from a comprehensive testing program, by which the subjects were assessed at the age of 15, with results from the same tests when performed on deaf eighth-graders in the sixties.

Results from both studies point to the importance of easily accessible communication, i.e. a visual/gestural language mode, to social as well as intellectual development in deaf children. It is also clear that the structure and dynamic development of a group of children had a great impact on an individual child's chances of success. Compared to orally trained age-mates two decades earlier deaf eighth-graders in the eighties showed an increased level of theoretical achievement. They were particularly superior in the understanding and use of written Swedish, but the difference was also evident in numerical and mathematical tests.

Keywords: Achievement test, deafness, sign language, social interaction, special education, video recording.

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Background

During the first two thirds of this century oral methods prevailed in the education and upbringing of deaf children in Sweden. The children were expected to rely on lip-reading, use of residual hearing (if any) and speech for communication. In the oral period most deaf children had virtually no functional language (spoken or signed) when they started school. The conduct of orally trained deaf children has given rise to the notion that a lack of hearing *per se* predestines a deaf child to a retarded and restricted development.

In the late sixties, however, attitudes toward sign language began to change, and in 1973 a systematic use of signs was introduced in special preschools for deaf children in the southernmost county of Sweden. In a supplement to the Curriculum for Compulsory Education (LGR 80), it was stated that education in Schools for the Deaf should be bilingual, in Sign Language and Swedish.

Then, for the first time, there was an opportunity to study the development of a fairly large group of deaf children who had had access to sign communication as early as the preschool period, or even before. Deaf children of deaf parents had been studied earlier, but they cannot be held to be representative of deaf children in general.

The two studies reported here were carried out within the framework of a longitudinal investigation - "Learning Processes and Personality Development in Deaf Children", located at the Department of Educational and Psychological Research, School of Education, Malmö, Sweden, from 1977 to 1991. The aim of the project was to document the development of prelingually deaf children exposed to sign communication in preschool age, and to try to explore factors influencing their development.

Method and main problems

Data were collected by way of video recordings in combination with direct observations, 4 to 10 times a year. The children were studied in natural situations in preschool and school. *The first study reported* here is founded on detailed analyses of video recordings, forming a qualitative description of social strategies used by four children with different social positions in the peer group. Two main questions were asked: In which way do different social strategies used by children influence social status among peers? Which factors can be found behind different social strategies?

In addition to the video recordings, the children were assessed by means of a series of more formal observations and tests, ending with a comprehensive

testing program at the age of 15. The program, mainly comprising tests of the Swedish language and tests of mathematical and numerical ability, had been used in a nationwide study of orally trained deaf pupils in 1965-69. All pupils in the eighth grade at the School for the Deaf in Lund were tested in 1985-89. *The second study reported* in the book is a comparison of these test results with results from the same tests when performed on deaf eighth-graders in the sixties. The most essential question is: Did the level of academic achievement in deaf pupils change when sign communication was introduced in school and preschool education?

Subjects

Twenty children, all except one of hearing parents, were included in the original group of subjects, comprising all prelingually deaf children attending preschools for hearing-impaired children in the southernmost county of Sweden in 1977. The children were born from 1970 to 1974, and they were all expected to go on to the Special School for the Deaf in Lund. In the second study, the group was extended to include class-mates of the original group - making a total of 40 subjects, 21 boys and 19 girls.

Hearing loss - degree and cause

The majority of the children (project group and class-mates) had average hearing-losses (dB HL) greater than 93 dB. Two pupils with moderate hearing losses had specific language disorders as well and had attended the School for the Deaf since starting school.

The cause of the hearing loss was hereditary in four subjects; eight were deaf due to maternal rubella; three were deaf due to CMV infection and six as a result of prematurity, often in combination with asphyxia at birth; one child was born with hydrocephalus; and three had suffered from meningitis in their early years. In 15 subjects the cause was unknown or uncertain.

A total of 11 pupils (25%) had additional physical problems, which influenced their learning ability and behavior to a greater or lesser degree. Three suffered from CNS disturbances which mainly affected their motor behavior; three had visual problems which could not be corrected by glasses; two had medical disorders influencing their general condition; and five subjects had specific language disorders. A few had more than one additional disability. Psycho-social problems did exist, but were not considered in this study.

Sign language

When the systematic use of sign communication was introduced in the special kindergarten groups for hearing-impaired children, preschool staff as well as hearing parents used so-called simultaneous communication, i.e. signs and speech at the same time. Most of the children in the relevant group had no access to sign communication before joining a special preschool group, or until they began at the School for the Deaf. Some of them started preschool rather late; some, too, moved in from regions where sign language was not equally accepted. A few had residual hearing which at that time was considered to motivate the exclusive use of speech, as it was thought that signing would interfere with the development of speech. Sign language was thus introduced at a wide variety of ages.

Table 1. Age when signs were made available to the child. (Subjects in the original project group in parentheses)

0-2 yrs	2-3 yrs	3-4 yrs	4-5 yrs	5-6 yrs	6 yrs-	Total
3(1)	5(3)	10(7)	8(6)	3(1)	11(0)	40(18)

Among the children who did not learn sign language until their sixth year, there were four who were advised to postpone school for one year due to poor language skills in signs as well as speech.

When they left the compulsory school, all subjects were fluent in sign language. Some of them had been able to develop a relatively good oral language as well, but their interpersonal mode of communication was sign language.

Reading instruction and communication at the School for the Deaf

Throughout the primary and intermediate levels, the teachers (all hearing) used various combinations of signs and speech, ranging from a fluent simultaneous communication to mainly oral instruction supported by finger-spelling and single signs. At the secondary level, some teachers used sign language exclusively. Reading and writing have mainly been taught in a holistic, functional way in school. During a period in the late seventies, reading and writing were also introduced in play activities in some of the preschool groups.

Study of social strategies

The qualitative study of social strategies focused on four children during their last year in preschool and their first years in school. Informal observation had indicated that they had very different social positions in their peer groups, and for two of them an obvious change of status occurred during the years in question. From an adult point of view, it was difficult to understand why these children elicited such different responses from others and why their positions were modified or maintained.

Detailed analyses of series of video recordings yielded a collection of "typical sequences of interaction" for each child, and successive descriptions of characteristic behavior patterns were formed.

The written records of these "typical interactions" were sorted into three main categories or key situations, elucidating the different strategies of the children: 1. Ability to obtain attention and establish contact; 2. Flexibility of behavior - to do the appropriate thing, in the appropriate way, at the appropriate moment, with the appropriate person; 3. Ability to cooperate and handle conflicts.

It was clear, however, that the structure and dynamic development of a group of children had a great impact on an individual child's chances of success. Sign-language competence also became increasingly important over the years.

The successful children knew how to gain attention and how to avoid it, while one of the low-status children spent a lot of energy on efforts to "be seen". Popular children noticed situational cues and were able to adjust their behavior to partners and circumstances, whereas the less popular ones were less flexible. The latter also seemed to possess a narrower behavioral repertoire and were thus less capable of avoiding conflicts. Non-verbal communicative skills allowed one child a certain level of influence in preschool; but these skills turned out to be insufficent, and unable to make up for poor language, in social interactions in school.

Study of the achievement level in grade 8

In the course of five years, from 1985 to 1989, the eighth-graders at the School for the Deaf in Lund were assessed by means of a testing program comprising aptitude, achievement and problem-solving tests. When the program was developed by Nordén (1975) in the sixties, it also included practical tests and was designed to be used as an instrument of educational and vocational guidance.

The aim of this study was to compare the comprehension and use of the Swedish language and mathematical/numerical ability in deaf eighth-graders from the two different decades.

As at least some of the language tests from the original program could be expected to be too easy, the assessment was extended by two language tests not previously used with deaf subjects. A number of problem-solving tests and tests of spatial and perceptual ability were chosen to complement the results of the tests of theoretical knowledge.

Instructions were imparted by signs, demonstrations and - in the case of language tests - in writing. In order to ascertain that all subjects really knew what to do, several exercises were performed by all pupils together. The examiner checked the answers on the exercise sheets and helped if necessary.

With some of the tests, the deaf group was allowed additional time compared to the norms for hearing subjects. Factor analyses of preliminary results from the sixties had revealed that when time was short, real differences in achievement were concealed by a common time factor. A change of pens (pencil and red pencil) was made at the end of the original time limit. This allowed for a comparison with hearing subjects, as it was possible to count the items solved with the different pens.

The norms calculated in the sixties, expressed in a Stanine scale, were used in this study as well. Data were mainly analyzed by Analysis of Variance (ANOVA) and Multiple Classification Analysis (MCA).

Test results

Table 2. Test results. Pupils in grade 8 at Schools for the Deaf 1967-69 (Nordén) and 1985-89 (Heiling).

Test	1967-69 (n=104) M	sd	1985-89 (n=40) M	sd	F	p	eta^2
Opposites	11.4	3.67	15.8	3.25	42.7	***	0.23
DLS 4-6	15.3	6.01	19.0	6.09	10.9	***	0.07
DLS 7-9[1]			22.5	7.02			
Sentences[1]			5.9	3.98			
Composition	4.6	2.19	5.4	2.33	3.7	-	0.03
Addition	31.9	10.69	32.6	9.82	0.1	-	0.00
Multiplication	22.1	10.60	28.3	9.40	10.3	**	0.07
Arithmetic	18.7	7.62	22.8	8.31	7.7	**	0.05
R16C	9.2	4.69	11.7	5.42	7.4	**	0.05
Comb.of numbers	9.7	4.01	11.8	3.37	8.1	**	0.05
Raven's matrices	38.8	9.48	40.3	7.62	0.8	-	0.01
Puzzle	9.7	4.11	9.9	3.74	0.0	-	0.00
NIIP	3.6	1.76	3.1	1.71	2.2	-	0.02
F1	1.9	0.73	1.8	0.85	0.6	-	0.00
Substitutes	157.0	44.01	154.9	44.33	0.1	-	0.00
Identical figures	41.4	11.77	44.7	12.65	2.2	-	0.02

1) Only used in the 1985-89 study.

Initially, it can be concluded that results on Raven's Progressive Matrices do not indicate any difference in general intellectual ability between the groups from the two decades. Differences in results from other tests have to be explained by other factors than a dissimilar average level of intelligence.

Significant differences can be found with regard to several tests. The difference is great in tests of word knowledge and reading comprehension (Opposites, DLS 4-6), and it is also evident in numerical tests (Multiplication, Arithmetic) and mathematical tests (Combination of numbers, R16C). Although the difference in Written Composition is barely significant, the eta^2 value tells us that it should not pass unnoticed.

With one exception, then, all tests of theoretical knowledge showed that the achievement level has risen, results from tests of spatial and perceptual ability remaining the same.

The single test in respect of which the achievement level was unchanged, Addition, probably represents a skill mastered by most eighth-graders in the sixties, whereas other rules of arithmetic were less well known to them.

From earlier studies (e.g. Nordén, 1975; Conrad, 1977; Allen, 1986), we know that deaf subjects generally score lower than hearing age-mates in tests of academic achievement. With problem-solving tests and tests of spatial and perceptual ability, differences are generally much smaller or negligible. Research has also consistently demonstrated that deaf subjects rarely reach or exceed a reading proficiency comparable to that of a hearing child in fourth grade.

To investigate whether this was still the case, the results of the subjects in this study were compared to norms for hearing children. As a change of pens had been ordered at the time limits for hearing groups in the case of tests where extended time was allowed for deaf subjects, items solved within the shorter time limit could easily be counted. It was also possible to study whether or not the added time had had any effect upon the achievement level.

It turned out that the extended time was mainly important in tests of verbal ability. When subjects were allowed to work for a few minutes longer, their average results in reading-comprehension tests (DLS 4-6, DLS 7-9), and in a test of word knowledge (Opposites), exceeded the fourth grade level. Within the shorter time, 14 subjects (35%) achieved as well as, or better than, the average hearing fourth-grader. Five pupils had results comparable to, or better than, the average hearing *eighth*-grader.

All verbal tests comprised a group of poor performers, many of whom had additional physical handicaps or problems. For these pupils, the extended time did not result in much of a change.

Most deaf subjects found the cloze test - Sentences - extremely difficult. It calls for reading comprehension, syntactical competence and knowledge of idiomatic phrases. Many pupils obviously understood the sentence, but could not find the correct word to fill in. It is worth noticing, however, that three pupils attained or exceeded the average fourth-grade level.

Although deaf subjects in the eighties have made substantial gains in writing skills compared to their age-mates in the sixties, they are still far from the fluency and flexibility achieved by hearing subjects. Important qualitative differences can be noticed between subjects from the two decades, however. In the sixties, stereotyped phrases virtually devoid of personal information were common - probably as an artifact of language *training*. Deaf pupils twenty years later never used standardized phrases. They tried to impart information, even if they were not always able to write with grammatical and syntactical correctness.

With regard to the tests of numerical and mathematical ability, none of which demanded reading proficiency, around 40 per cent of the deaf subjects in 1985-89 had results equal to, or better than, an average hearing eighth-grader. A group of very poor performers could be found in these tests as well. It is interesting to note, however, that pupils with additional disorders were generally

neither at the very low extreme nor at a level comparable to that of hearing age-mates.

During the years of testing, it was obvious that different classes did not perform equally well. Even when differences in average level of intelligence, average degree of hearing loss, and parental socio-economic status were eliminated by statistical means, two groups (tested in 1985 and 1989) generally outperformed the others.

The video recordings and the qualitative study focused on the social interaction of the children, entailing an opportunity for teachers to be out of sight. Consequently we cannot account for teacher influence in the different groups.

Though teacher behavior can probably explain some of the differences between groups, there were other factors that turned out to be worth exploring. Being the school psychologist, the author had access to information concerning the history of the children before they started school. Through personal visits and conference notes, I also had a chance to study group processes and changes in group structure. When this information was compiled, it added considerably to the explanation of the group differences. Combined with the qualitative studies of the social strategies of four children, it was conducive to a more profound understanding of the developmental conditions affecting each individual.

Conclusions and suggestions for further research

Both studies included in this thesis point to the importance of easily accessible communication, i.e. a visual/gestural language mode, to social as well as intellectual development in deaf children. Though many of the subjects in this group were exposed to signs fairly late during the preschool period, and despite the fact that the sign language used by their parents and teachers was incomplete and rather influenced by Swedish grammar, these children were much better off than their age-mates during the sixties, who were brought up in a strong oral tradition. Family relations had generally been more "normal", as parents and children had been able to communicate with each other. In preschools, deaf peers and signing adults had allowed the deaf child to explore the world outside the family. As a consequence, most of the children started school with a general level of knowledge and a social competence that were not common in earlier groups of deaf children. As eighth-graders, they showed an increased level of academic achievement compared to their orally trained age-mates from the sixties. They were particularly superior in the understanding and use of written Swedish.

Both studies also illustrate the importance of including the social context, both on a micro and a macro level, in the description of social as well as intellectual development.

Several invitations to further research emerged: In this and other reports from the longitudinal project mentioned above, characteristic traits and behaviors of individual children, and interaction between children, have been described. It now seems necessary to apply a wider focus in order to analyze group dynamics and the influence of teachers and other adults on group development. The socio-cultural climate in and around schools and preschools for the deaf has to be considered as well.

Most deaf children starting school nowadays have had early access to, and are fluent in, Sign Language, and the majority acquire a reading proficiency above functional level. A longitudinal study of their understanding and use of written Swedish would be of great interest. Will their extended experience of reading mean an automatized knowledge of Swedish grammar and syntax now uncommon in deaf pupils? To what extent will sign language grammar and syntax influence their writing?

Several authors have called for evaluation and research concerning instruction in mathematics and science for the deaf, now an almost entirely neglected area.

A continuous follow-up of academic-achievement levels would indicate whether the gains demonstrated in this study are part of an ongoing trend or not. If comparisons with hearing pupils are to be made, care must be taken to ensure that testing conditions and test items are equally suitable for deaf and hearing subjects.

A more detailed report is available in Swedish (Heiling, 1993) and a translation is under preparation.

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